

lunar features were readily distinguishable through the deep copper-coloured shade. During totality the relative brightness of the limb was also noticeable, a thin ring appearing to encircle the darkened disc. The beauty of the phenomenon was considerably increased by the apparition of previously unseen stars, notably the Pleiades, when the extreme brightness of the moon was reduced. It is gratifying to notice that the new 8-inch equatorial of the Birmingham University Observatory was employed by Mr. Fournier in taking some fifteen photographs of the eclipsed moon during the various phases of the eclipse; exposures of from one to thirty seconds were given.

CERULLI'S COMET, 1910e.—Numerous observations of the comet discovered by Dr. Cerulli on November 9 appear in the supplement to No. 4454 of the *Astronomische Nachrichten*. As seen by Prof. Hartwig at Bamberg on November 11 the comet was of the tenth magnitude, round, 2 diameter, and had a faint condensation.

From observations made on November 9, 10, and 11, Dr. Ebell has calculated a set of elements and an ephemeris, and from the former it appears that perihelion passage took place on September 15; at present the comet is about 95 million miles from the earth, and is receding at the rate of 720,000 miles daily. Apparently it is travelling nearly due south through the southern limits of Taurus, as shown by the following extract from the ephemeris:—

Ephemeris 12h. M.T. Berlin.

1910	α (true) h. m.	δ (true) ° ' "	1910	α (true) h. m.	δ (true) ° ' "
Nov. 23 ...	3 37.3 ...	+5 37.4	Dec. 1 ...	3 36.9 ...	+4 24.5
„ 27 ...	3 37.0 ...	+4 58.0	„ 5 ...	3 36.9 ...	+3 57.3

SELENIUM PHOTOMETRY OF STARS.—A paper of more than usual interest, in which the author discusses at length his measures of Algol, made with his selenium photometer, is contributed by Dr. Joel Stebbins to No. 3, vol. xxxii., of the *Astrophysical Journal*. The photometer was attached to a 12-inch refractor, and was kept at a uniform temperature of 0° C. or lower; the galvanometer current was kept working continuously, and between each ten seconds' exposure to a star the cell was rested for about a minute in order to recover; α and δ Persei were used as comparisons.

Under these necessary conditions very careful observations were made, and Dr. Stebbins considers that the results show the method to be capable of greater accuracy than is attained in visual observations. Among many interesting results accruing from the work, the following call for special mention. The companion gives more light than the sun, and is much brighter on the side turned towards Algol. A secondary minimum, some thirty-five hours after the principal minimum, was detected, the variation being only 0.06 magnitude. The discussion indicates that the radius of the companion is 1.14 that of Algol, while the limiting densities are 0.12 and 0.18 of the sun's density respectively. The total period comes out as 68.816h., and the duration of the eclipse as 9.8h. The greater luminosity of the one side of the companion, which appears to rotate and revolve in the same time, may be accounted for by supposing that it is intensely heated by radiations from the primary; this is in general agreement with Dr. Nordmann's suggestion that the temperature of Algol, as measured by his method, is great enough to raise the surface of the satellite to incandescence. Taking the parallax of the system as +0.07" and the sun's magnitude as -26.6, the total light of Algol is 26; the total light of the faint hemisphere of companion is 1.7, and of the bright side 3.0; this would give stellar magnitudes of 2.2, 5.2, and 4.6 respectively. But if Kapteyn's adopted value for the parallax, +0.029", and his magnitude of the sun, -26.1, be employed, these brightnesses become, respectively, 240, 16, and 28 times that of the sun.

Many other points, such as the density, magnitude, and form of the system of Algol, are also discussed in Dr. Stebbins's paper.

THE SECULAR ACCELERATION OF THE MOON'S MEAN MOTION.—In No. 4454 of the *Astronomische Nachrichten* Dr. Robert Bryant advances the tentative suggestion that the secular acceleration of the moon's mean motion may

be due to the accretion of "dust" from interplanetary space by the moon and the earth. He finds that a deposit of 2 mm. of "dust" per century on the lunar surface would, if the density of the "dust" were equal to the mean density of the moon, account for about 6" per century in the moon's longitude; a deposit on the earth would also be reflected in the longitude of the satellite.

It is also suggested that uniform distribution of the "dust" is improbable, hence irregularities would accrue. If the earth does collect sufficient "dust" in this way, its rotation period would be affected irregularly, and astronomy of precision would obviously be confronted by a serious difficulty.

PHOTOGRAPHIC MAGNITUDES OF SEVENTY-ONE PLEIADES STARS.—From the extra-focal images impressed upon thirteen plates taken early in March last, Herr Adolf Hnatek has determined the photographic magnitudes of seventy-one stars in the Pleiades group, and now publishes the results in No. 4449 of the *Astronomische Nachrichten*. The photographs were taken with the 14-inch photographic refractor of the Vienna Observatory, 10 mm. inside the focus, and the author publishes an interesting discussion of the results and the method whereby they were derived; an especially interesting point discussed is the effect on the apparent magnitude caused by the distance from the centre of the plate.

ELEMENTS AND NUMBERS OF RECENTLY DISCOVERED MINOR PLANETS.—Prof. Neugebauer publishes, in No. 4454 of the *Astronomische Nachrichten* the elements and permanent numbers of eighteen minor planets discovered during 1909; the last number allotted is 691, so that the total number of discoveries must, by now, be well above 700.

A NEW THEORY OF THE DESCENT OF MAN.¹

THE first of the memoirs referred to below relates to the discovery of a new Palæolithic skeleton, and contains a careful report by Hauser on the excavation, along with a critical description of the skeleton and a comparison of the same with other known types, more especially with the Neanderthal man, from the pen of Prof. Klaatsch.

The conclusion arrived at is that the Neanderthal man and the Aurignac man represent two entirely different types of mankind.

According to Hauser's report, the skeleton of the Aurignac man was found early in 1909, at the Palæolithic site of Combe-Capelle, not far from Montferrand (Périgord), at a depth of 1.54 m. in a typical Aurignacian stratum, as was clearly proved by the artefacts found with the skeleton. The skeleton lay under a rock shelter, and was almost complete, the only imperfections being due to the displacement of certain parts by overturned masses of rock. As to the position of the body, the knees were strongly bent and drawn towards the head; the feet were also drawn together in a way which suggested a squatting position. After the whole skeleton had been removed, it was evident that the ground had been artificially prepared for the burial of the dead. There were found in the grave, typical Aurignacian artefacts of beautiful form, and perforated specimens of *Nassa reticulata*, a small marine snail, these articles being evidently intended for grave finery. The mode of burial showed the high state of culture of the Aurignac man.

A glance at diagrams of the Neanderthal and Aurignac skulls is sufficient to show the smaller breadth and more considerable height of the latter as compared with the former. Klaatsch directs attention to the stronger arching of the forehead of the Aurignac man, the greater bregma angle and calottic height, both according to Schwalbe's system as well as his own; the calottic height measurement of the Neanderthal skull is 40.4, while that

¹ H. Klaatsch und O. Hauser, "Homo aurignacensis Hauseri, ein palæolithischer Skelettfund aus dem unteren Aurignacien der Station Combe-capelle bei Montferrand (Périgord)." *Prähistorische Zeitschrift*, 1910, Heft 3-4, pp. 273-323, Tafel xxv-xxxv und drei Beilagen. (Berlin, 1910.)
H. Klaatsch, "Die Aurignac-Rasse und ihre Stellung im Stammbaum der Menschheit." *Zeitschrift für Ethnologie*, Jahrgang, 1910, Heft 3-4, pp. 515-577, Mit Tafel ii-iv und 46 Figuren im Text. (Berlin, 1910.)

of the Aurignac skull is 54.45. The excessive prominence of the Neanderthal skull in the frontal region is absent in the Aurignac skull, in which there is no development of an undivided torus supraorbitalis. Corresponding differences between the Aurignac and the Neanderthal skulls are found in the posterior region. The marked separation of the torus occipitalis transversus into a right and left half, which characterises the Neanderthal skull, is completely wanting in the Aurignac skull, of which the posterior region exhibits a quite remarkable conical extension. The place corresponding to the transverse inion prominence of the Neanderthal type is occupied by a sharp transverse ridge. The region of the planum nuchale lying below this shows a slightly hollowed surface.

In adults of primitive types of men, the sinus transversus does not coincide with the linea nuchae superior, as in modern Europeans. This condition is found both in the Neanderthal and in the Aurignac skull; it is, however, not to be regarded as evidence of an affinity between these two races, but merely as a character preserved from a common primitive condition.

In the temporal bone there is, in the case of the Aurignac man, a considerable protuberance of the conical-shaped mastoid, which contrasts strongly with the broad, low mastoid of the Neanderthal skull.

The cavity for the origin of the posterior belly of the digastric muscle is, in the case of the Neanderthal skulls

vergence phenomenon. It is to be regarded as such because it is essentially a superficial resemblance, and exhibits great differences in its mode of origin. For example, the temporal muscles have left their imprint on quite different parts of the sides of the skull, from which it is to be inferred that before the beginning of this process the two skull forms were undoubtedly different, the orang having a higher forehead and a smaller supraorbital prominence than the gorilla.

On the other hand, Klaatsch finds in the ratio of the longitudinal and transverse diameters of the head of the humerus a morphological character which is important for the determination of affinities. We can here select only a few of the numerous details which serve as vouchers for the affinity between the orang and the Aurignac man on one hand, and between the gorilla and the Neanderthal man on the other.

The spina tuberculi majoris and the sulcus intertubercularis of the humerus in the case of Aurignac man and the orang run almost straight down, while in the case of Neanderthal man and the gorilla they both describe a medial convex curve. The peculiar rough insertion of the pectoral muscle is common to the Neanderthal and the gorilla. On the tibia, the relief of the posterior surface of the malleolus—the grooves for the flexor muscles—is deeper in the case of the orang than in the case of the gorilla; the same distinction holds between

the Aurignac and the Neanderthal. On the femur, the trochanter minor in the case of the Neanderthal and gorilla is further down the shaft, and projects more inwards, while in the case of the Aurignac and the orang it projects backwards. The Aurignac-orang type exhibits also in the distal part a distinctly projecting, obliquely descending, crista intertrochanterica; in the Neanderthal-gorilla type there occurs that weakening of the ridge above the trochanter minor to which Klaatsch has already directed attention in the Neanderthal femur.

The shaft of the Aurignac femur is remarkable for its extraordinary straightness, and we find the same character in general with the orang. In contradistinction to this is the forward convex bend of the Neanderthal and gorilla femurs.

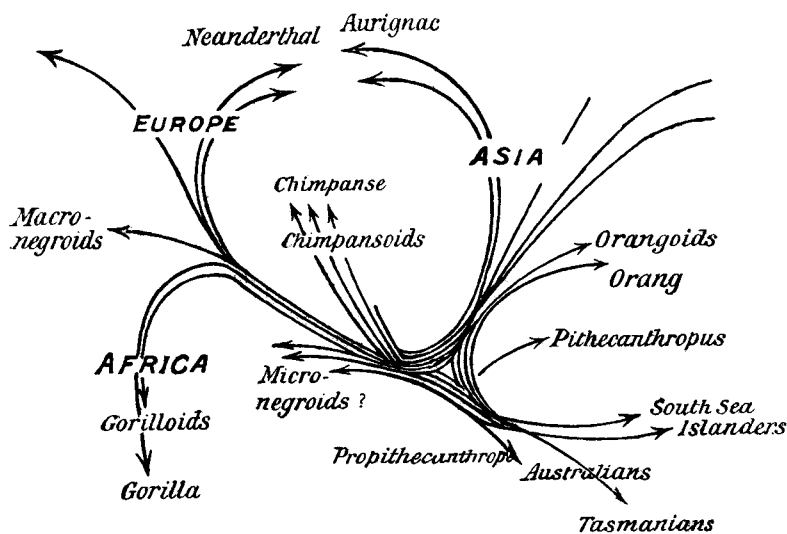
Klaatsch supports his theory by many more morphological details. Of special interest are the congruence phenomena which are shown by the curve diagrams of the tibia to exist

between Aurignac and the orang and the gorilla and Neanderthal, as well as the similarity of the shaft proportions of the tibia of Spy and the gorilla.

All these details show that there exists an affinity in important morphological details between the Aurignac man and the orang-utan and between the Neanderthal man and the gorilla, and that this does not rest only on the general impression produced by the graceful and slender appearance of many of the parts of the orang and Aurignac as contrasted with the rough and thick-set build of the gorilla and Neanderthal.

These considerations unfold to us promising views of the coming problems of anthropology, and throw new light on our present conceptions of the phylogeny of the human race. From a study of the osteological details we are driven to the conclusion that at a very early epoch there branched off from the primeval common mass of our forerunners—Propithecantropi, as Klaatsch calls them—a great western stream and a great eastern stream. Inside each of these groups new segregations occurred which led partly to the formation of races of anthropoid apes and partly to the formation of races of men.

The anthropoid apes are to be regarded as representing the unsuccessful attempts and dashes forward towards the goal of the definite creation of the human race—submerged branches of the primeval humanity which, in adapting themselves to special conditions of life, were



Spy, Moustier), wide and flat, and makes its appearance behind the mastoid. In the Aurignac skull the digastric groove is narrow and slight.

The tympanicum is, in the Aurignac skull, of remarkable delicacy, but is of considerable thickness both in the Moustier and Spy remains (Neanderthal type).

The formation of the facial bones also shows quite fundamental differences in the two types.

A fuller discussion of the anatomical details of the skeletons is outside the scope of a short article, and for this the reader is referred, especially as regards the anatomy of the extremities, to the original memoir.

The second memoir lays claim to the widest interest, especially as regards its conclusions about the general biology of man, and promises to open up new paths for the study of the morphological details of the skeletons of the primates. A series of special morphological results leads to the discovery of a parallel between the differences of the Aurignac and Neanderthal men, and the differences of the gorilla and orang-utan.

These considerations demand especially a rigid separation of accidental convergence phenomena from such characteristics of morphological details which must have been conserved by heredity alone, since they have no demonstrable connection with functional adaptations.

The external resemblance of the orang, of the gorilla, and of man in the sagittal and occipital crests is a con-

compelled in the struggle for existence to sacrifice important parts of their organisation, while a more favoured collateral branch, in quiet progressive evolution, developed into a human race.

By a new kind of diagram Klaatsch endeavours to elucidate the distribution of the human races and the anthropoid apes. The femur of *Pithecanthropus* fixes its position in the neighbourhood of the eastern group. The chimpanzee is in many respects further removed from the gorilla than from the Neanderthal man. The African races exhibit some affinities with the Neanderthal type. As to the eastern people, the similarities between the skulls of young orangs and the skulls of Javanese, which impressed certain authors, require further investigation.

With the help of his new theory, Klaatsch promises us a new interpretation of single pieces of the diluvial find of Krapina, some of these apparently belonging to the Aurignac type and others the Neanderthal type.

Of all earlier finds, the skeletal remains from Galley Hill, Kent, have the greatest affinity with the Aurignac man. Less certain are the affinities of the skull from Engis. A new comparison of the other diluvial and early prehistoric finds from the point of view of the new theory appears to be highly desirable.

RICHARD N. WEGNER.

MINERAL PRODUCTION OF INDIA.¹

THIS quinquennial review of the mineral output of India is probably the last official publication of Sir Thomas Holland in his capacity as Director of the Geological Survey of India, and it is especially appropriate that this should be so, seeing not only that he originated this most useful form of publishing the records of Indian mineral production, but that he has been the first of all the directors of the Survey to recognise that the chief duty of this survey is to assist and encourage the development of the mineral resources of the country. It is an undoubted fact, to which the present report bears eloquent witness, that the mineral production of India increased during Sir Thomas Holland's directorship at a rate with which no previous similar period of Indian history can show any comparison.

A glance at the records before us shows that the last five years have continued the energetic development of the mineral resources of the peninsula; as pointed out by the authors, it is practically impossible to set up any unexceptional standard of valuation, so that accurate comparisons cannot well be looked for; yet, even allowing for this fact, an increase in the estimated value of the output from 3,455,565*l.* in 1898 to 5,047,201*l.* in 1903, and from this figure, again, to 7,880,832*l.* in 1908, is a clear proof of a steady rise in the exploitation of these important resources of our Indian Empire. Of the total value thus assigned to the production, about two-thirds are made up of two items, gold and coal, the latter being now by far the more important; in 1903 the value of the gold was nearly twice that assigned to the coal, whereas in 1908 the latter figure was about 50 per cent. greater than the former. The gold output has, in fact, remained just about stationary during the period under review, the great bulk of it coming, as hitherto, from the Mysore mines.

The important increase in the coal production is perhaps one of the most satisfactory features indicated in this report; from 1½ million tons in 1884, the output rose steadily to 8½ millions in 1905, and then more rapidly to nearly 13 millions in 1908. About 90 per cent. of the entire output comes from Bengal, and about 50 per cent. from a single coalfield, namely, Jherria, which is now the leading coalfield, having gone ahead of Ranigunj since 1906. A very interesting statement is here published concerning the geological age of these Bengal coalfields; they occur in the Damuda series of the Gondwana system, which has always been looked upon as of Mesozoic age, the Lower Gondwanas being classed as probably of

Triassic and the Upper Gondwanas as probably of Jurassic age, thus making the coal-bearing formations much younger than those of Europe. On palæontological evidence, it is now possible to assert that the Lower Gondwanas are Palæozoic, and "certainly not younger than the Upper Carboniferous. Thus the Indian Coal-measures are not much younger than, and may even be of the same age as, those of Europe."

The only other point of especial importance is, in contradistinction to the first one, a purely economic one, namely, the fact that within the period under review the first battery of bye-product coke ovens has been erected on an Indian coalfield, namely, at Giridih.

During the five years to which this report refers the number of persons engaged in coal-mining has increased from 92,740 to 129,173, the numbers of those at work underground being respectively 64,969 and 83,164. The output has thus risen more rapidly than the number of persons employed, showing an increase in efficiency in the workers. The output per person employed has risen from 88.6 tons in 1904 to 98.8 tons in 1908, and per worker underground from 126.4 tons in 1904 to 153.5 tons in 1908. The efficiency of the Indian worker is thus approximately one-third of that of the worker in the United Kingdom; as is correctly pointed out in the report, this figure does not properly represent the ratio of labour efficiency, because in India a great deal of work is done by hand which in the United Kingdom is done by machinery, simply on account of the cheapness and abundance of labour in the peninsula. The death-rate from accidents has shown a marked tendency to increase during the last five years, but it is not possible to say whether this fact is due to the increasing depth of the mines or to accidental circumstances; its average over the five years 1904-8 is 0.98 per 1000 persons employed, or 10.2 per 1,000,000 tons of coal raised; the corresponding figures for the United Kingdom in 1906 were 1.29 and 4.37 respectively.

Another mineral that now bulks largely in the mineral production of India is manganese ore, the output of which shows a very marked increase, namely, from 150,190 tons in 1904 to 674,315 tons in 1908. The output in this latter year was about 228,000 tons less than that of the previous year, the falling off being due to market conditions, and in no wise indicating that the productive capacity has reached its zenith and is commencing to decline; on the contrary, it may be confidently anticipated that the general expansion above indicated will continue. The interesting economic question is raised whether it would not be preferable to smelt a considerable proportion of this ore on the spot, and thus export ferro-manganese instead of manganese ore; seeing that about one-fourth of the selling price of the ore represents the cost of freight, it is obvious that the possibility exists of effecting a very considerable saving, and the question should well merit investigation at the hands of the producers of manganese ore.

India is of great importance as a producer of mica, the Indian output being well over one-half of the world's total production. Here again a great increase is to be noted, namely, from 22,164 cwt. in 1904 to 53,543 cwt. in 1908.

The production of petroleum, still almost entirely from Burma, has also shown an increase, namely, from 118,491,382 gallons in 1904 to 176,646,320 gallons in 1908; even this latter figure is insufficient to supply the needs of the country, which imported about 70 million gallons in 1908.

It may be fairly said that the above comprise the mineral products of most importance; there are, of course, numerous others, and in most cases these show a marked increase in output. It is gratifying to find that the exertions of a scientific institution like the Geological Survey are having such a beneficial effect upon the economic development of the peninsula; and whilst congratulating Sir Thomas Holland upon the success in this direction that has attended his tenure of the directorship of the Geological Survey, we may express the hope that this expansion of the material interests of the country will continue to be the first care of his successors, with the same gratifying results.

H. LOUIS.

¹ "Quinquennial Review of the Mineral Production of India during the Years 1904 to 1908." By Sir Thomas H. Holland, K.C.I.E., F.R.S., and Dr. L. Leigh Fermor. Records of the Geological Survey of India, vol. xxxix. Pp. 280+8 plates. (Calcutta: Geological Survey; London: Kegan Paul and Co., Ltd., 1910.) Price 2 rupees.